APPENDIX H

Evaluation of Hydraulic Containment Alternatives

GSI ENVIRONMENTAL

TO: Mr. Steve Smith, Solutia Inc.

FROM: Shahla Farhat, James Kearley, and Charles Newell

RE: Evaluation of Hydraulic Containment Alternatives
Sauget Area 1 Feasibility Study, Sauget and Cahokia, Illinois

EXECUTIVE SUMMARY

Hydraulic containment of affected groundwater downgradient of Sites G, H, and I South is a component of Alternatives 7 and 8 of the Sauget Area 1 Feasibility Study. As requested by Solutia Inc. (Solutia), GSI Environmental Inc. (GSI) used the regional groundwater flow and transport model for the American Bottoms Aquifer (GSI, 2008; GSI, 2012) to evaluate the number of wells and flow rate required to cut off the Sauget Area 1 groundwater plume at the downgradient boundary of the Sauget Area 1 study area.

Containment of the Sauget Area 1 chlorobenzene plume at the downgradient boundary of the Sauget Area 1 study area was obtained using five wells screened in the MHU and DHU and located south of the W.G. Krummrich plant boundary. Overall, a total pumping rate of 1850 gpm was required to contain the Sauget Area 1 chlorobenzene plume.

Operation of the five modeled extraction wells at 1850 gpm along the Krummrich plant boundary (i.e., Alternative 7) would likely result in a significantly reduced time to clean for the portion of the Sauget Area 1 plume located between the five modeled extraction wells and the Mississippi River. However, there are other sources (i.e., at the Krummrich plant and at Sauget Area 2) that would result in continued impacts to the groundwater in the area between the modeled extraction wells and the River.

Alternative 7 would not significantly reduce time to clean for the area between the Sauget Area 1 sources (i.e., Sites G, H, and I South) and the modeled extraction wells. The modeled extraction wells in Alternative 7 would have to remain in operation for a long period of time at 1850 gpm to continue to contain the affected groundwater between the Sauget Area 1 sources and the modeled extraction wells, and the extracted groundwater would require treatment at the PChem Plant and the American Bottoms Plant. Based on planning-level cost estimates, the annual operation and maintenance (O&M) cost for Alternative 7, including groundwater treatment costs, is $5.5 million per year. The estimated present value cost for Alternative 7 for 30 years of operation is $78.9 million.

Alternative 8 includes the hydraulic containment system plus groundwater recovery in the residual DNAPL source zones at Sites G, H, and I South, with an estimated total pumping rate of 2800 gpm. Based on planning-level cost estimates, the annual operation and maintenance (O&M) cost for Alternative 8, including groundwater treatment costs, is $8.2 million per year. The estimated present value cost for Alternative 8 for 30 years of operation is $113 million.

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BACKGROUND

The Sauget Area 1 Feasibility Study includes screening of nine potential remedial alternatives. Groundwater extraction and treatment is a component of Alternatives 7 and 8.

Alternative 7 includes high-capacity extraction wells for hydraulic containment at the downgradient edge of the Sauget Area 1 study area. The extraction wells would be screened in the Middle Hydrogeologic Unit (MHU) and the Deep Hydrogeologic Unit (DHU). The groundwater would be routed for treatment at the PChem Plant and the American Bottoms Plant. Alternative 7 also includes institutional controls, O&M of the Judith Lane Containment Cell, monitored natural attenuation (MNA), utility relocation, recovery of pooled DNAPL at well BR-I, and RCRA caps at Sites G, H, I South, and L.

Alternative 8 includes all of the components in Alternative 7 plus extraction of groundwater from the residual DNAPL source areas at Sites G, H, and I South using high-capacity extraction wells screened in the MHU and DHU.

GSI used the regional groundwater flow and transport model for the American Bottoms Aquifer (GSI, 2008; GSI, 2012) to evaluate the number of wells and flow rate required to cut off the Sauget Area 1 groundwater plume at the downgradient boundary of the Sauget Area 1 study area.

Based on groundwater modeling results, preliminary, planning level cost estimates were developed for Alternatives 7 and 8 for use in the alternative screening process in the Feasibility Study.

MODEL SIMULATIONS

The fate and transport model is described in detail in the *Regional Groundwater Flow and Contaminant Transport Model* report (GSI, 2008) and *2012 Update of Regional Groundwater Flow and Transport Mode*l memorandum (GSI, 2012). Therefore, only changes pertaining to the above mentioned evaluations are discussed in this memorandum.

The scenarios were modeled with the following key considerations:

- The MODFLOW and MT3D models were run under transient conditions from 1960 to 2038.
- Only Sauget Area 1 sources were used in the simulations.
- Based on the fate and transport model simulations (GSI, 2008, 2012), chlorobenzene represents the largest groundwater plume, therefore this constituent was used for the current analysis as a conservative representative of site constituents from Sauget Area 1.
- Simulated extraction wells were placed at locations along the downgradient sides of the Sauget Area 1 study area (i.e., along the east side of Route 3 and along the southern boundary of the W.G. Krummrich Plant). The locations, number, and pumping rates of the wells were varied until containment of the Sauget Area 1 plume

was obtained. For the purpose of this modeling study, it was assumed that installation and startup of the hydraulic containment system would occur in 2015.

Key model attributes, assumptions, and input data for the groundwater model are listed below:

- A non-uniform finite-difference grid with 60 ft by 60 ft cells in the vicinity of the Sauget Area 2 GMCS was used with cell size gradually increasing with distance from Site R. Adjacent model cell column and row widths were not altered by more than a factor of 1.5 (ASTM D 5880-95). This type of variable-size grid provides a good balance between simulation accuracy and run time.

- Three layers were used in the model: i) an unconfined Shallow Hydrogeologic Unit (SHU) with a porosity of 0.30; ii) a convertible confined/unconfined MHU; and iii) a confined DHU. Geologic descriptions and hydraulic conductivity data indicate that the SHU can serve as a semi-confining layer for the deeper hydrogeologic units. There are no aquitards restricting vertical groundwater flow between the MHU and DHU.

- A horizontal hydraulic conductivity of $5x10^{-3}$ centimeters per second (cm/sec) was used for the SHU. Hydraulic conductivity data compiled by Schicht (1965) were used for the MHU and DHU.

- Bedrock elevations, which form the bottom of the lowest layer (DHU, Layer 3 in the model), were established by Kriging data contained in Bergstrom and Walker (Figure 2 in Bergstrom and Walker, 1956), results from a small-area geophysical study of an area near the Krummrich facility, and available boring log data.

- The Mississippi River was modeled using MODFLOW's river package. The areal extent of the river was obtained from USGS topographic maps and URS figures. Each river cell was assigned a river stage (assumed constant for all river cells in the model), river bottom elevation (based on U.S. Corps of Engineers bathymetric cross sections), and a conductance term. An average river level stage of 390.12 ft Mean Sea Level was used for the river in the study area.

- Constant head cells were used in the model to represent the eastern boundary of the modeled area (the bluff line) based on "steady-state" constant head elevations used in a regional groundwater flow model developed by Clark (1997).

- A surface infiltration rate of 7.8 inches per year was used in the model to represent infiltration from rainfall.

- The groundwater migration control system (GMCS) was incorporated into the model. The GMCS system consists of a "U"-shaped slurry wall (3 ft wide, 3,300 ft long, 140 ft deep) (Solutia, 2002; URS, 2004) located between Sauget Area 2 Site R and the Mississippi River and three groundwater extraction wells between the slurry wall and Site R. A hydraulic conductivity of $1.4x10^{-8}$ cm/sec (Solutia, 2005) was used for the slurry wall extending from the SHU to the DHU in the model. The slurry wall was modeled using MODFLOW's Horizontal Flow Barrier package.

MODELING RESULTS TO EVALUATE CUTOFF OF CHLOROBENZENE PLUME

Initially, the model simulations were run with extraction wells located along the east side of Illinois Route 3. However, groundwater extraction at these locations was unable to prevent further offsite migration of the Sauget Area 1 chlorobenzene plume. Plume containment was obtained using five (5) wells located immediately south of the W.G. Krummrich plant boundary (Figure 1). A total pumping rate of 1850 gpm from the MHU and DHU was required to prevent further offsite migration of the chlorobenzene plume.

Operation of the five modeled extraction wells at 1850 gpm along the Krummrich plant boundary (i.e., Alternative 7) would likely result in a significantly reduced time to clean for the portion of the Sauget Area 1 plume located between the five modeled extraction wells and the River. However, there are other sources (i.e., at the Krummrich plant and at Sauget Area 2) that would result in continued impacts to the groundwater in the area between the modeled extraction wells and the River.

Alternative 7 would not significantly reduce time to clean for the area between the Sauget Area 1 sources (i.e., Sites G, H, and I South) and the modeled extraction wells along the Krummrich Plant boundary. The modeled extraction wells in Alternative 7 would have to remain in operation for a long period of time at 1850 gpm to continue to contain the affected groundwater between the Sauget Area 1 sources and the modeled extraction wells. As discussed below, the cost to install and operate this system for a long period of time would be relatively high.

PLANNING-LEVEL COSTS FOR ALTERNATIVES 7 AND 8

Appendix F of the Sauget Area 1 Feasibility Study (GSI, 2012b) presents detailed planning-level cost estimates for Alternatives 2 through 5 to provide an accuracy of minus 30% to plus 50%. The cost estimates in Appendix F were developed in accordance with USEPA guidance (USEPA, 2000), vendor quotations, Remedial Action Cost Engineering Requirements (RACER) software, cost information from previous projects, and engineering judgment. Finally a discount rate was used in calculating present worth costs for the Sauget Area 1 alternatives.

The cost estimates include capital and annual O&M costs. Capital costs include direct costs for construction of remedy components as well as indirect costs such as remedial design, project management, overhead, and implementation of institutional controls. Annual O&M costs include environmental sampling and testing and the O&M of any remediation equipment or systems that remain in operation after remedy construction is complete. A contingency was applied to capital costs and annual O&M costs based on the degree of uncertainty in the scope of work (due to incomplete design) and to account for construction contingency.

The detailed cost table for Alternative 3 was used as the starting point for developing the planning-level costs for Alternatives 7 and 8, which are shown on Tables H-1 and H-2 of this memorandum. The highlighted lines on Tables H-1 and H-2 are the cost elements associated with groundwater extraction and treatment, and these costs are based on engineering judgment.

The hydraulic containment system for Alternative 7 would have to keep operating for a long period of time at 1850 gpm to continue to contain the plumes that originate at the Sauget Area 1 residual DNAPL source areas. The extracted groundwater would be routed to the PChem Plant for preliminary and primary treatment and then to the American Bottoms Plant for secondary treatment. The estimated groundwater treatment fees include $1.50 per thousand gallons for the PChem Plant and $3.74 per thousand gallons for the American Bottoms Plant. As shown on Table H-1, the annual O&M cost for Alternative 7, including groundwater treatment costs, is approximately $5.5 million per year. The estimated present value cost for Alternative 7 for 30 years of operation is $78.9 million.

Alternative 8 includes the hydraulic containment system plus groundwater recovery in the residual DNAPL source zones at Sites G, H, and I South, with an estimated total pumping rate of 2800 gpm. This pumping rate was not modeled. Instead, it was based on an assumption that the cumulative pumping rate for Alternative 8 would be approximately 50% higher than the rate for Alternative 7. Based on planning-level cost estimates shown on Table H-2, the annual O&M cost for Alternative 8, including groundwater treatment costs, is $8.2 million per year, and the estimated present value cost for Alternative 8 for 30 years of operation is $113 million.

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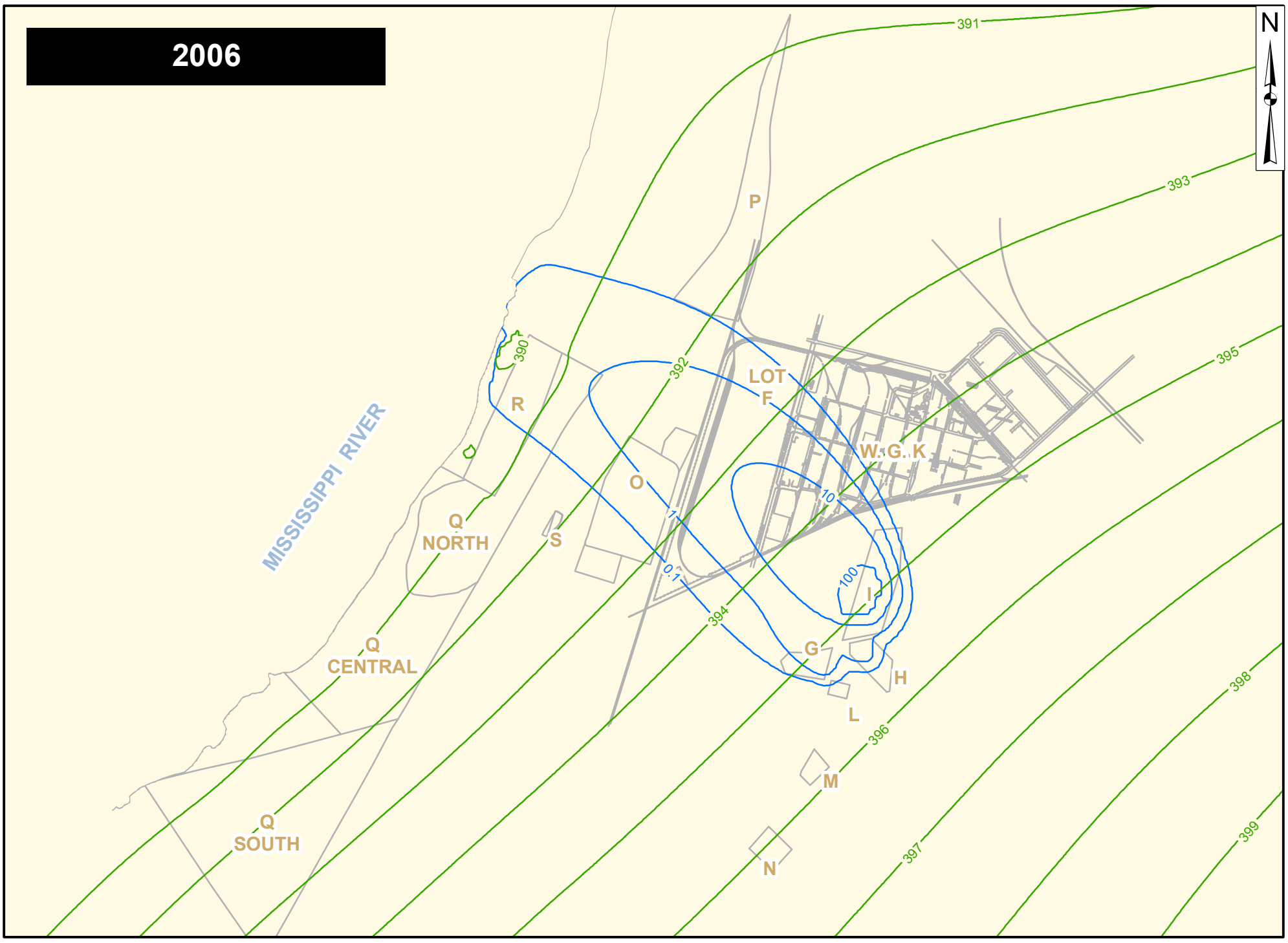
GSI Job No. G-3767
Issued: 31-May 2012

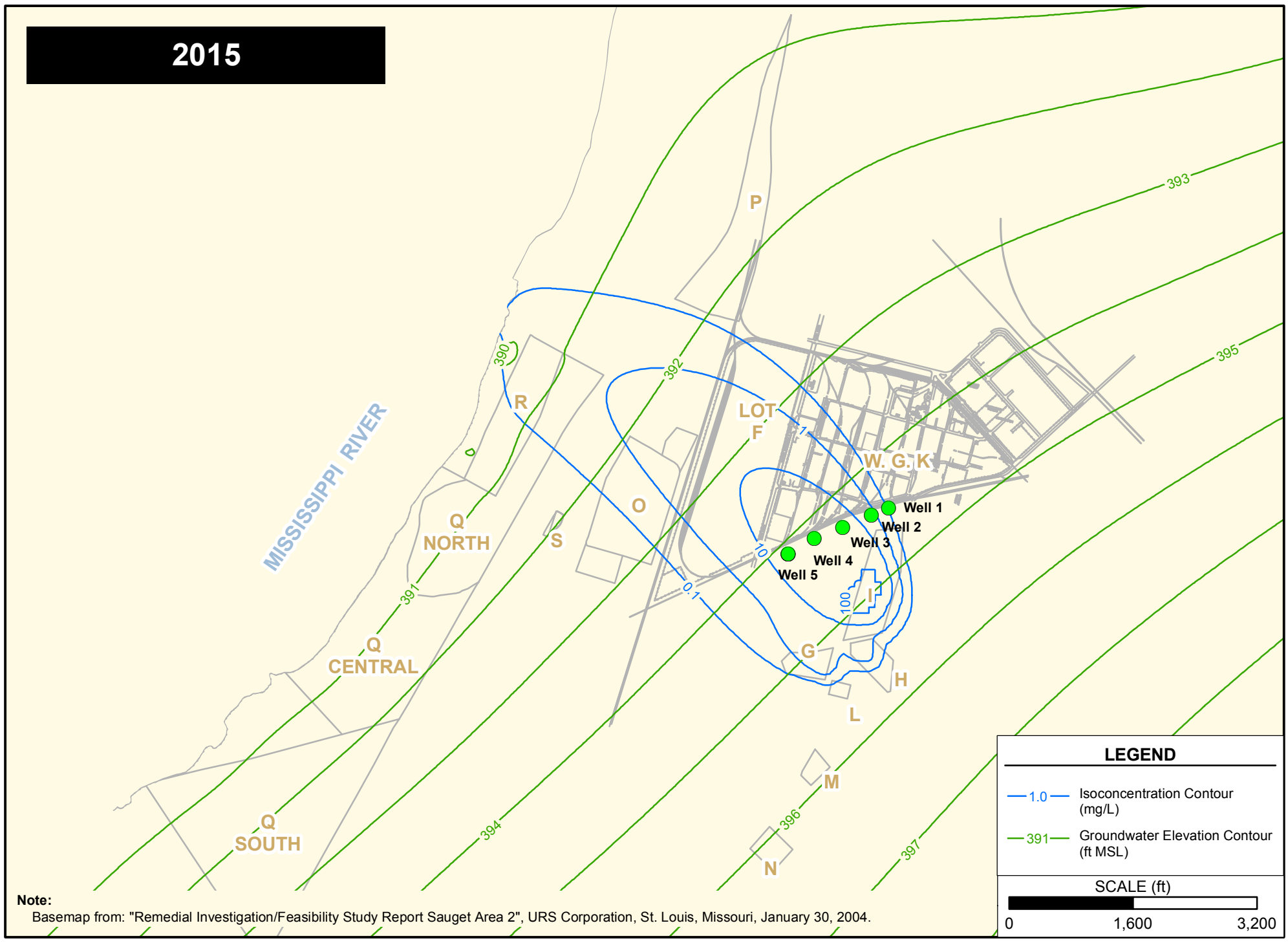
EVALUATION OF HYDRAULIC CONTAINMENT ALTERNATIVE
Sauget Area 1, Sauget and Cahokia, Illinois

FIGURE AND TABLES

2006



2015



LEGEND

- 1.0 — Isoconcentration Contour (mg/L)
- 391 — Groundwater Elevation Contour (ft MSL)

SCALE (ft)

0 — 1,600 — 3,200

Note:
Basemap from: "Remedial Investigation/Feasibility Study Report Sauget Area 2", URS Corporation, St. Louis, Missouri, January 30, 2004.

GSI ENVIRONMENTAL

GSI Job No. G-3767	Drawn By: SKF/CDM
Issued: 31-May-12	Reviewed By: SKF
Revised: --	Approved By: SKF
Scale: As Shown	**FIGURE H.1**

Simulated Chlorobenzene Plume - 2006 and 2015
Middle Hydrogeologic Unit (Layer 2 in Model)

REGIONAL GROUNDWATER FATE AND TRANSPORT MODEL
American Bottoms Aquifer

Table H-1
Cost Estimate Summary- Alternative 7
Sauget Area 1 FS, Sauget and Cahokia, IL

Description of Alternative 7:

Alternative 7 includes MNA, Judith Lane Containment Cell O&M, institutional controls, utility relocation, pooled DNAPL recovery at well BR-I, capping at Sites G, H, I South, and L. Capital costs occur in Year 0. Annual O&M costs occur in years 1 to 10 for pooled DNAPL recovery at BR-I and in years 1 to 30 for all other remedy components.

This alternative also includes 5 groundwater extraction wells for hydraulic containment. Total flowrate of 1850 gpm.

CAPITAL COSTS

DESCRIPTION	QTY	UNITS	UNIT RATE	TOTAL	
Installation of Wells for MNA Sampling Program					
Monitoring wells in SHU	8	EA	$3,400	$27,200	
Monitoring wells in MHU	13	EA	$6,600	$85,800	
Monitoring wells in DHU	13	EA	$7,800	$101,400	
SUBTOTAL				$214,400	
Relocation of water fuel and phone lines	1	LS	$512,000	$512,000	
DNAPL Recovery System Modification	1	LS	$14,400	$14,400	
Capping Site G (2.53 acres)	1	LS	$781,400	$781,400	
Asphalt Cover site G West (0.79 acres)	1	LS	$101,000	$101,000	
Capping Site H (4.87 acres)	1	LS	$1,450,000	$1,450,000	
Capping Site I South (8.79 acres)	1	LS	$2,620,000	$2,620,000	
Capping Site L (1.08 acres)	1	LS	$300,800	$300,800	
Installation of 5 extraction wells, pumps, elec	5	LS	$100,000	$500,000	
Installation of pipeline to sewer system	1	LS	$100,000	$100,000	
SUBTOTAL				$5,853,200	
SUBTOTAL				$6,594,000	
Contingency	25%			$1,648,500	15% scope + 10% bid
SUBTOTAL				$8,242,500	
Project Management	5%			$412,125	
Remedial Design	8%			$659,400	
Construction Management	6%			$494,550	
Institutional Controls					
Institutional Controls Plan	1	LS	$8,000	$8,000	
Security Fence at Sites H and L	2800	LF	$53	$148,702	
Hazardous Waste Signing	14	EA	$72	$1,011	
Prepare & file deed notices	1	LS	$20,000	$20,000	Legal fees
Site information database	1	LS	$5,000	$5,000	Set up data mgt system
SUBTOTAL				$182,713	
TOTAL CAPITAL COST				**$9,991,288**	

Table H-1
Cost Estimate Summary- Alternative 7
Sauget Area 1 FS, Sauget and Cahokia, IL

O&M COSTS, Years 1 to 10

DESCRIPTION	QTY	UNITS	UNIT RATE	TOTAL	
MNA Sampling (34 wells for VOCs, SVOCs, geochemical indicators)					
Semiannual GW sampling & testing	2	1/2-YR	$37,300	$74,600	
Annual GW monitoring report	1	YR	$15,000	$15,000	
SUBTOTAL				$89,600	
Judith Lane Containment Cell O&M					
Judith Lane Containment Cell O&M	1	YR	$30,000	$30,000	
Judith Lane Containment Cell Well Sampl	4	QTR	$4,900	$19,600	
SUBTOTAL				$49,600	
DNAPL Recovery System					
Recovery System O&M	1	YR	$23,700	$23,700	
Transportation and Disposal of DNAPL and Water	1	YR	$33,500	$33,500	
SUBTOTAL				$57,200	
Maintenance of Caps and Covers	1	YR	$35,000	$35,000	
Pump maintenance / well replacement	1	YR	$75,000	$75,000	
SUBTOTAL				$306,400	
Contingency	20%			$61,280	10% scope + 10% bid
SUBTOTAL				$367,680	
Project Management	8%			$29,414	
Technical Support	10%			$36,768	
ICs-site info database	1	LS	$2,500	$2,500	Update database
P-Chem Plant (1850 gpm, $1.50/tho gal)	1	YR	$1,458,500	$1,458,500	
Amer. Bottoms (1850 gpm, $3.74/tho gal)	1	YR	$3,636,600	$3,636,600	
Monthly electricity cost for extraction wells	12	MO	$4,000	$48,000	
				$5,211,782	
TOTAL ANNUAL O&M COST				**$5,579,462**	

Table H-1
Cost Estimate Summary- Alternative 7
Sauget Area 1 FS, Sauget and Cahokia, IL

O&M COSTS, Years 11 to 30

DESCRIPTION	QTY	UNITS	UNIT RATE	TOTAL	
MNA Sampling (34 wells for VOCs, SVOCs, geochemical indicators)					
Semiannual GW sampling & testing	2	1/2-YR	$37,300	$74,600	
Annual GW monitoring report	1	YR	$15,000	$15,000	
SUBTOTAL				$89,600	
Judith Lane Containment Cell O&M					
Judith Lane Containment Cell O&M	1	YR	$30,000	$30,000	
Judith Lane Containment Cell Well Sampl	4	QTR	$4,900	$19,600	
SUBTOTAL				$49,600	
DNAPL Recovery System O&M (not applicable)				$0	
Maintenance of Caps and Covers	1	YR	$35,000	$35,000	
Pump maintenance / well replacement	1	YR	$75,000	$75,000	
SUBTOTAL				$249,200	
Contingency	20%			$49,840	10% scope + 10% bid
SUBTOTAL				$299,040	
Project Management	8%			$23,923	
Technical Support	10%			$29,904	
ICs-site info database	1	LS	$2,500	$2,500	Update database
P-Chem Plant (1850 gpm, $1.50/tho gal)	1	YR	$1,458,500	$1,458,500	
Amer. Bottoms (1850 gpm, $3.74/tho gal)	1	YR	$3,636,600	$3,636,600	
Monthly electricity cost for extraction wells	12	MO	$4,000	$48,000	
				$5,199,427	
TOTAL ANNUAL O&M COST				**$5,498,467**	

Table H-1
Cost Estimate Summary- Alternative 7
Sauget Area 1 FS, Sauget and Cahokia, IL

PERIODIC COSTS

DESCRIPTION	YEAR	QTY	UNITS	UNIT RATE	TOTAL	
Five Year Review Report	5	1	LS	$30,000	$30,000	Report at end of Year 5
Update ICs Plan	5	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$33,000	
Five Year Review Report	10	1	LS	$20,000	$20,000	Report at end of Year 10
Update ICs Plan	10	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	15	1	LS	$20,000	$20,000	Report at end of Year 15
Update ICs Plan	15	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	20	1	LS	$20,000	$20,000	Report at end of Year 20
Update ICs Plan	20	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	25	1	LS	$20,000	$20,000	Report at end of Year 25
Update ICs Plan	25	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	30	1	LS	$20,000	$20,000	Report at end of Year 30
Update ICs Plan	30	1	LS	$3,000	$3,000	Updated plan
Plugging of Monitoring Wells	30	1	LS	$26,600	$26,600	
Plugging of Extraction Wells	30	1	LS	$15,000	$15,000	
SUBTOTAL					$64,600	
TOTAL PERIODIC COST					**$189,600**	

PRESENT VALUE ANALYSIS

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (7%)		PRESENT VALUE
Capital Cost	0	$9,991,288	$9,991,288	1.000	$	9,991,288
Annual O&M Cost 1-10	1-10	$55,794,624	$5,579,462	see calc	$	39,187,806
Annual O&M Cost 11-30	11-30	$109,969,344	$5,498,467	see calc	$	29,611,772
Periodic Cost	5	$33,000	$33,000	0.713	$	23,529
Periodic Cost	10	$23,000	$23,000	0.508	$	11,692
Periodic Cost	15	$23,000	$23,000	0.362	$	8,336
Periodic Cost	20	$23,000	$23,000	0.258	$	5,944
Periodic Cost	25	$23,000	$23,000	0.184	$	4,238
Periodic Cost	30	$64,600	$64,600	0.131	$	8,486
		$175,944,856				**$78,853,091**

TOTAL PRESENT VALUE COST FOR ALTERNATIVE 7	**$78,853,091**

Table H-2
Cost Estimate Summary- Alternative 8
Sauget Area 1 FS, Sauget and Cahokia, IL

Description of Alternative 8:

Alternative 8 includes MNA, Judith Lane Containment Cell O&M, institutional controls, utility relocation, pooled DNAPL recovery at well BR-I, capping at Sites G, H, I South, and L. Capital costs occur in Year 0. Annual O&M costs occur in years 1 to 10 for pooled DNAPL recovery at BR-I and in years 1 to 30 for all other remedy components.
This alternative also includes 8 groundwater extraction wells (3 for source areas, 5 for hydraulic containment). Total flowrate of 2800 gpm.

CAPITAL COSTS

DESCRIPTION	QTY	UNITS	UNIT RATE	TOTAL	
Installation of Wells for MNA Sampling Program					
Monitoring wells in SHU	8	EA	$3,400	$27,200	
Monitoring wells in MHU	13	EA	$6,600	$85,800	
Monitoring wells in DHU	13	EA	$7,800	$101,400	
SUBTOTAL				$214,400	
Relocation of water fuel and phone lines	1	LS	$512,000	$512,000	
DNAPL Recovery System Modification	1	LS	$14,400	$14,400	
Capping Site G (2.53 acres)	1	LS	$781,400	$781,400	
Asphalt Cover site G West (0.79 acres)	1	LS	$101,000	$101,000	
Capping Site H (4.87 acres)	1	LS	$1,450,000	$1,450,000	
Capping Site I South (8.79 acres)	1	LS	$2,620,000	$2,620,000	
Capping Site L (1.08 acres)	1	LS	$300,800	$300,800	
Installation of 8 extraction wells, pumps, elec	8	LS	$100,000	$800,000	
Installation of pipelines to sewer system	1	LS	$200,000	$200,000	
SUBTOTAL				$6,253,200	
SUBTOTAL				$6,994,000	
Contingency	25%			$1,748,500	15% scope + 10% bid
SUBTOTAL				$8,742,500	
Project Management	5%			$437,125	
Remedial Design	8%			$699,400	
Construction Management	6%			$524,550	
Institutional Controls					
Institutional Controls Plan	1	LS	$8,000	$8,000	
Security Fence at Sites H and L	2800	LF	$53	$148,702	
Hazardous Waste Signing	14	EA	$72	$1,011	
Prepare & file deed notices	1	LS	$20,000	$20,000	Legal fees
Site information database	1	LS	$5,000	$5,000	Set up data mgt system
SUBTOTAL				$182,713	
TOTAL CAPITAL COST				**$10,586,288**	

Table H-2
Cost Estimate Summary- Alternative 8
Sauget Area 1 FS, Sauget and Cahokia, IL

O&M COSTS, Years 1 to 10

DESCRIPTION	QTY	UNITS	UNIT RATE	TOTAL	
MNA Sampling (34 wells for VOCs, SVOCs, geochemical indicators)					
Semiannual GW sampling & testing	2	1/2-YR	$37,300	$74,600	
Annual GW monitoring report	1	YR	$15,000	$15,000	
SUBTOTAL				$89,600	
Judith Lane Containment Cell O&M					
Judith Lane Containment Cell O&M	1	YR	$30,000	$30,000	
Judith Lane Containment Cell Well Sampl	4	QTR	$4,900	$19,600	
SUBTOTAL				$49,600	
DNAPL Recovery System					
Recovery System O&M	1	YR	$23,700	$23,700	
Transportation and Disposal of DNAPL and Water	1	YR	$33,500	$33,500	
SUBTOTAL				$57,200	
Maintenance of Caps and Covers	1	YR	$35,000	$35,000	
Pump maintenance / well replacement	1	YR	$100,000	$100,000	
SUBTOTAL				$331,400	
Contingency	20%			$66,280	10% scope + 10% bid
SUBTOTAL				$397,680	
Project Management	8%			$31,814	
Technical Support	10%			$39,768	
ICs-site info database	1	LS	$2,500	$2,500	Update database
P-Chem Plant (2800 gpm, $1.50/tho gal)	1	YR	$2,207,250	$2,207,250	
Amer. Bottoms (2800 gpm, $3.74/tho gal)	1	YR	$5,504,100	$5,504,100	
Monthly electricity cost for extraction wells	12	MO	$6,000	$72,000	
				$7,857,432	
TOTAL ANNUAL O&M COST				**$8,255,112**	

Table H-2
Cost Estimate Summary- Alternative 8
Sauget Area 1 FS, Sauget and Cahokia, IL

O&M COSTS, Years 11 to 30

DESCRIPTION	QTY	UNITS	UNIT RATE	TOTAL	
MNA Sampling (34 wells for VOCs, SVOCs, geochemical indicators)					
Semiannual GW sampling & testing	2	1/2-YR	$37,300	$74,600	
Annual GW monitoring report	1	YR	$15,000	$15,000	
SUBTOTAL				$89,600	
Judith Lane Containment Cell O&M					
Judith Lane Containment Cell O&M	1	YR	$30,000	$30,000	
Judith Lane Containment Cell Well Sampl	4	QTR	$4,900	$19,600	
SUBTOTAL				$49,600	
DNAPL Recovery System O&M (not applicable)				$0	
Maintenance of Caps and Covers	1	YR	$35,000	$35,000	
Pump maintenance / well replacement	1	YR	$100,000	$100,000	
SUBTOTAL				$274,200	
Contingency	20%			$54,840	10% scope + 10% bid
SUBTOTAL				$329,040	
Project Management	8%			$26,323	
Technical Support	10%			$32,904	
ICs-site info database	1	LS	$2,500	$2,500	Update database
P-Chem Plant (2800 gpm, $1.50/tho gal)	1	YR	$2,207,250	$2,207,250	
Amer. Bottoms (2800 gpm, $3.74/tho gal)	1	YR	$5,504,100	$5,504,100	
Monthly electricity cost for extraction wells	12	MO	$6,000	$72,000	
				$7,845,077	
TOTAL ANNUAL O&M COST				**$8,174,117**	

Table H-2
Cost Estimate Summary- Alternative 8
Sauget Area 1 FS, Sauget and Cahokia, IL

PERIODIC COSTS

DESCRIPTION	YEAR	QTY	UNITS	UNIT RATE	TOTAL	
Five Year Review Report	5	1	LS	$30,000	$30,000	Report at end of Year 5
Update ICs Plan	5	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$33,000	
Five Year Review Report	10	1	LS	$20,000	$20,000	Report at end of Year 10
Update ICs Plan	10	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	15	1	LS	$20,000	$20,000	Report at end of Year 15
Update ICs Plan	15	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	20	1	LS	$20,000	$20,000	Report at end of Year 20
Update ICs Plan	20	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	25	1	LS	$20,000	$20,000	Report at end of Year 25
Update ICs Plan	25	1	LS	$3,000	$3,000	Updated plan
SUBTOTAL					$23,000	
Five Year Review Report	30	1	LS	$20,000	$20,000	Report at end of Year 30
Update ICs Plan	30	1	LS	$3,000	$3,000	Updated plan
Plugging of Monitoring Wells	30	1	LS	$26,600	$26,600	
Plugging of Extraction Wells	30	1	LS	$24,000	$24,000	
SUBTOTAL					$73,600	
TOTAL PERIODIC COST					**$198,600**	

PRESENT VALUE ANALYSIS

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (7%)		PRESENT VALUE
Capital Cost	0	$10,586,288	$10,586,288	1.000	$	10,586,288
Annual O&M Cost 1-10	1-10	$82,551,124	$8,255,112	see calc	$	57,980,452
Annual O&M Cost 11-30	11-30	$163,482,344	$8,174,117	see calc	$	44,021,377
Periodic Cost	5	$33,000	$33,000	0.713	$	23,529
Periodic Cost	10	$23,000	$23,000	0.508	$	11,692
Periodic Cost	15	$23,000	$23,000	0.362	$	8,336
Periodic Cost	20	$23,000	$23,000	0.258	$	5,944
Periodic Cost	25	$23,000	$23,000	0.184	$	4,238
Periodic Cost	30	$73,600	$73,600	0.131	$	9,669
		$256,818,356				**$112,651,524**

TOTAL PRESENT VALUE COST FOR ALTERNATIVE 8	**$112,651,524**